Claims

1. A combination reaction product of at least two chemical compounds, each one of these chemical compounds comprising:
   a) a chemical moiety (p,q,r,s) potentially capable of performing a binding interaction with a single target molecule;
   b) an oligonucleotide (b,b',b'',b''') or functional analogue thereof with at least one self-assembly moiety (m,m',m'',m''');

   the chemical compounds being bound to each other by their self-assembly moieties (m,m',m'',m'''), **characterized in that** the combination reaction product is stable in the absence of said target molecule, wherein the oligonucleotides (b,b',b'',b''') or functional analogues of at least one of the chemical compounds comprise a variable, unique coding sequence (b2,b2',b2'',b2''') individually coding for the identification of the particular chemical moiety (p,q,r,s).

2. The combination reaction product of claim 1, **characterized in that** the self-assembly moieties (m,m',m'',m''') are a self-assembly sequences (b1,b1',b1'',b1''') of the oligonucleotides (b,b',b'',b'''), functional analogues thereof, ligands (l) capable to perform a complex reaction with a specific ion (i), or peptides capable of association with other molecules.

3. The combination reaction product of one of claims 1 or 2, **characterized in that** the at least two chemical compounds each comprise a chemical group by which they are covalently linked together after the stable combination reaction product had been formed.

4. The combination reaction product of one of claims 1 to 3, **characterized in that** the oligonucleotides (b,b',b'',b''') or functional analogues thereof are covalently and directly linked to the chemical moieties (p,q,r,s).

5. The combination reaction product of one of claims 1 to 4, **characterized in that** the oligonucleotides (b,b',b'',b''') or functional analogues thereof further comprise a linking portion (b3,b3',b3'',b3''') which is situated between the self-assembly sequence (b1,b1',b1'',b1''') and the chemical moiety (p,q,r,s).

6. The combination reaction product of one of claims 1 to 5, **characterized in that** the coding sequence (b2,b2',b2'',b2''') of oligonucleotide (b,b',b'',b''') or the functional analogue thereof is situated between the chemical moiety (p,q,r,s) and the self-assembly sequence (b1,b1',b1'',b1''').

7. The combination reaction product of one of claims 1 to 6, **characterized in that** it is a dimer, trimer or tetramer exhibiting chemical moieties (p,q,r,s).

8. A chemical library comprising combination reaction products of at least two chemical compounds, each one of these chemical compounds comprising:
   a) a chemical moiety (p,q,r,s) potentially capable of performing a binding interaction with a single target molecule;
   b) an oligonucleotide (b,b',b'',b''') or functional analogue thereof with at least one self-assembly moiety (m,m',m'',m''');

   the chemical compounds being bound to each other by their self-assembly moieties (m,m',m'',m'''), **characterized in that** the combination reaction product is stable in the absence of said target molecule, wherein the oligonucleotides (b,b',b'',b''') or functional analogues of at least one of the chemical compounds comprise a variable, unique coding sequence (b2,b2',b2'',b2''') individually coding for the identification of the particular chemical moiety (p,q,r,s).

9. The chemical library of claim 8, **characterized in that** the self-assembly moieties (m,m',m'',m''') are a self-assembly sequences (b1,b1',b1'',b1''') of the oligonucleotides (b,b',b'',b'''), functional analogues thereof, ligands (l) capable to perform a complex reaction with a specific ion (i), or peptides capable of association with other molecules.

10. The chemical library of one of claims 8 or 9, **characterized in that** the at least two chemical compounds each comprise a chemical group by which they are covalently linked together after the stable combination reaction product had been formed.

11. The chemical library according to one of claims 8 to 10, **characterized in that** it comprises combination reaction products according to any one of claims 4 to 7.

12. The chemical library according to one of claims 8 to 11, **characterized in that** its individual combinations of moieties (p,q,r,s) is derived by forming heteroduplexes, heterotriplexes or heteroquadruplexes of the self-assembly sequences (b1,b1',b1'',b1''') of the oligonucleotides (b,b',b'',b''').

13. The chemical library according to one of claims 8 to 11, **characterized in that** its individual combinations of moieties (p,q,r,s) is derived by chelation of the self-assembly moieties (m,m',m'',m''') with specific ions (i).

14. The chemical library according to claim 12, **characterized in that** it comprises individually encoded sub-libraries (A) and (B), whereas sub-library (A) comprises **n** compounds coupled to the 3' extremity of **n** different DNA oligonucleotides (b) and sub-library (B) comprises **m** compounds coupled to the 5' extremity of **m** different DNA oligonucleotides (b').

15. The chemical library according to claim 14, **characterized in that** in sub-library (A) or in sub-library (B) respectively, iodoacetamido- or maleimido-derivatives of **n** or **m** chemical entities have been coupled to individual DNA oligonucleotides which carry a thiol group at the 3' or 5' end.

16. The chemical library according to claim 14, **characterized in that** in sub-library (A) or in sub-library (B) respectively, amide derivatives - forming chemical structures such as $-O-P(O)_2-O-(CH_2)n-NH-CO-R$, where R may correspond to a number of different chemical entities, and n may range be-

tween 1 and 10 - have been coupled to the oligonucleotides carrying a phosphodiester bond at one extremity.

17. The chemical library according to one of claims 14 to 16, **characterized in that** in sub-library (A) the self-assembly sequence (b1) is interrupted by a d-spacer in opposite position to a code (B), the d-spacer preventing any undesired pairing to the bases of code (B) which encodes sub-library (B), whereas the oligonucleotide (b) of sub-library (A) has its distinctive code (A) towards the 5' extremity.

18. A method of biopanning ligands specific for target molecules, wherein a combination reaction product is incubated with a target molecule, the combination reaction product consisting of at least two chemical compounds, each one of these chemical compounds comprising:
c) a chemical moiety (p,q,r,s) potentially capable of performing a binding interaction with a single target molecule;
d) an oligonucleotide (b,b',b'',b''') or functional analogue thereof with at least one self-assembly moiety (m,m',m'',m''');
wherein the chemical compounds are bound to each other by their self-assembly moieties (m,m',m'',m'''), **characterized in that** the combination reaction product is stable in the absence of said target molecule, wherein the oligonucleotides (b,b',b'',b''') or functional analogues of at least one of the chemical compounds comprise a variable, unique coding sequence (b2,b2',b2'',b2''') individually coding for the identification of the particular chemical moiety (p,q,r,s).

19. The method of claim 18, **characterized in that** combination reaction products according to at least one of claims 1 to 7 are utilized for biopanning.

20. The method of claim 18, **characterized in that** a chemical library of combination reaction products according to at least one of claims 8 to 17 is used for biopanning.

21. A method to identify a target molecule with a combination reaction product comprising a chemical moiety (p,q,r,s) capable of performing a binding interaction with this target molecule and further comprising an oligonucleotide (b,b',b'',b''') or functional analogue thereof, **characterized in that** the combination reaction product is bound to a target by biopanning according to at least one of claims 18 to 20.

22. The method of claim 21, **characterized in that** PCR-fragments are generated by polymerase chain reaction (PCR), each of which carries the code of pairs of sub-library members (A) and (B), whereas sub-library (A) comprises **n** compounds coupled to the 3' extremity of **n** different DNA oligonucleotides (b) and sub-library (B) comprises **m** compounds coupled to the 5' extremity of **m** different DNA oligonucleotides (b').

23. The method of claim 22, **characterized in that** in sub-library (A) or in sub-library (B) respectively, iodoacetamido- or maleido-derivatives of **n** or **m** chemical entities are coupled to individual DNA oligonucleotides, which carry a thiol group at the 3' or 5' end.

24. The method of claim 23, **characterized in that** in sub-library (A) the self-assembly sequence (b1) is interrupted by a d-spacer in opposite position to a code (B), the d-spacer preventing any undesired pairing to the bases of code (B) which encodes sub-library (B), whereas the oligonucleotide (b) of sub-library (A) has its distinctive code (A) towards the 5' extremity.

25. The method of at least one of claims 22 to 24, **characterized in that** the length of the PCR-fragments are checked and their sequence identity is established by digesting the PCR-fragments with a restriction site for a specific endopeptidase (e.g. *Eco*RI), followed by cloning into a suitable plasmid and sequencing.

26. The method of at least one of claims 22 to 25 where several specific binding members are isolated at the end of a biopanning experiment, **character-**

ized in that concatenamers are created, starting from the various PCR-fragments present in the reaction mixture, the concatenated sequences are "read" by sequencing, revealing both the identity and the frequency of pairs of code (A) and code (B).

27. The method of claim 22 where several specific binding members are isolated at the end of a biopanning experiment and sub-libraries (A) and/or (B) carry chemical moieties at the extremities of partially-annealing oligonucleotides **characterized in that** unpaired DNA strands are hybridized with target oligonucleotides (e.g. DNA oligonucleotides) being immobilized on one or more chips.

28. The method of claim 27, **characterized in that** by using chip (A) or chip (B) respectively, the reading of the identity and/or frequency of members of sub-library (A) or sub-library (B) respectively, rescued after a biopanning experiment, is carried out and by decoding on chip (A) and (B) candidate components of sub-libraries (A) and (B), to be re-annealed and screened in a successive round of bio-panning are suggested.

29. The method of claim 28, **characterized in that** increasingly stringent binding to the target is mirrored by a reduction in the number of (A) and/or (B) members as identified on the respective chip and the possible combinations of the candidate (A) and (B) members are assembled individually or in smaller pools and assayed for binding to the target.

30. The method of at least one of the claims 27 to 29, **characterized in that** libraries are allowed to self-assemble in order to form trimeric or tetrameric complexes by using three or four chips, respectively, which carry distinctive target oligonucleotides for decoding.

31. The method of at least one of the claims 27 to 31, **characterized in that** the DNA of selected binding moieties is PCR amplified prior to chip hybridization.